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Fish Stocking Assessment of Bruce Lake, 2002

R. J. Zemlak and D. M. Cowie
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Website: *www.bchydro.bc.ca/environment/initiatives/pwcp/*

This report has been approved by the Peace/Williston Fish and Wildlife Compensation Program Fish Technical Committee.

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BRUCE LAKE

WATERSHED:	Parsnip River
DATE OF SURVEY:	August 7- 8, 2002
FIELD CREW LEADER:	Randy J. Zemlak
FIELD ASSISSTANT:	Arne R. Langston

PEACE/WILLISTON FISH AND WILDLIFE COMPENSATION PROGRAM

B.C. HYDRO
GENERATION

and

MINISTRY OF WATER, LAND and AIR PROTECTION
ENVIRONMENTAL STEWARDSHIP DIVISION

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INTRODUCTION

Bruce Lake is located 23 km Southeast of Mackenzie BC (Table 1, Figure 1). The lake has received significant attention since 1989 from fish biologists with both the Ministry of Water, Land and Air Protection (MWLAP) and the Peace/Williston Fish and Wildlife Compensation Program (PWFWCP).

PWFWCP fish biologists conducted a standard fisheries baseline reconnaissance level survey of Bruce Lake in July 1989 (Jesson 1989). At that time, the lake was deemed suitable for game fish introductions and was stocked in the late eighties. In 1994, PWFW CP fish biologists then conducted an assessment to determine the stocking success and to identify potential enhancements projects (Zemlak and Langston 1994). Only rainbow and brook trout have been stocked in Bruce Lake. All of the above reports can be viewed at the PWFWCP office (address on cover page).

During August 2002, PWFWCP fish biologists re-investigated Bruce Lake primarily to evaluate the success of the current fish stocking program and to see if any changes were required. Future stocking recommendations from this evaluation would then be presented to the MWLAP for their approval/implementation.

Table 1. Lake Location

Location:	23 km southeast of Mackenzie BC
Elevation:	± 747 m
Latitude/Longitude:	55° 08' 295" : 122° 54' 49"
U.T.M.:	10.5056.61103 (NAD 1983)
Management Unit:	7-30
N.T.S. Map No.:	93 - O/2
Watershed:	Parsnip River
Waterbody Identifier:	00139PARS
Lake Drainage:	closed system: outlet drains into a small swamp

ACCESS

Although access to Bruce Lake has not changed significantly since the original reconnaissance level lake inventory (1989), exact road directions and conditions may have changed over time. Bruce lake can be accessed either by helicopter (as conducted in the 1994 survey) or by ATV. There is no direct vehicle road access to the lake.

From the Mackenzie Junction (Highway 39 and 97), drive north on Hwy 97 for 2.2 km. Turn left on a 4x4 single gravel road (gas pipeline road) and travel 2.1 km. At this point, an ATV is required. Go left on a small ATV trail (from gas pipeline road) and travel 2.7 km to Bruce Lake.

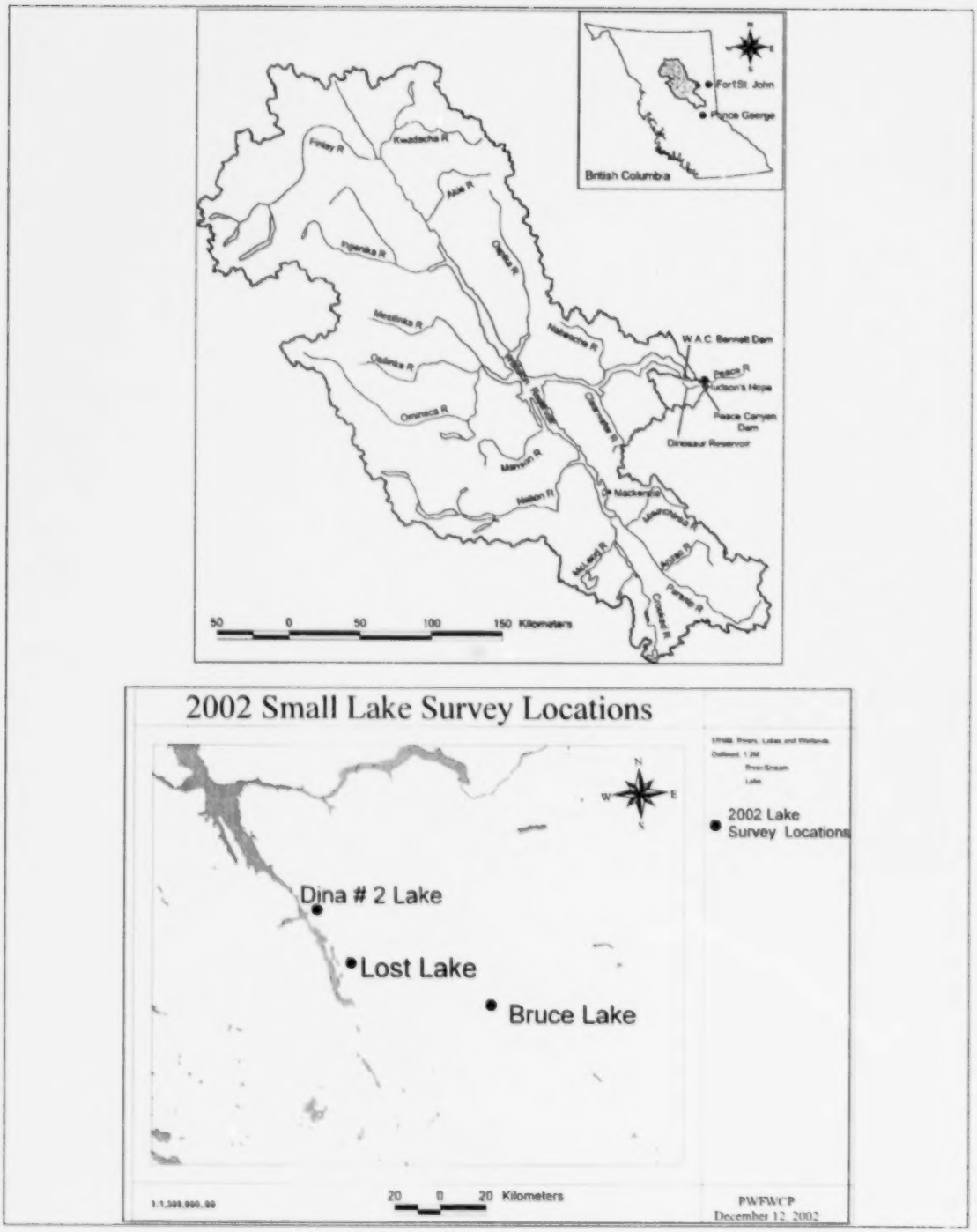

Figure 1. Location of Bruce Lake.

STOCKING HISTORY

Rainbow Trout

Rainbow trout were the first species of fish stocked in Bruce Lake. These fish have been stocked into Bruce Lake twice, initially 17,000 in 1989 and then another 5,000 in 1999 (Table 2). The original 1989 stocking of fish were assessed in 1994. At that time, it was discovered that the rainbow trout had reached their maximum life span and there were very few fish within the lake. The lake affords no spawning habitat so recruitment back into the lake was presumed to be non existent. Angler use on the lake was unknown but anecdotal information indicated that this particular lake was used by many ice fishermen.

Since the lake needed to be stocked again, the concept of switching stocks to brook trout was put forth. Brook trout are presumed to provide a better winter fishery than rainbow trout and have been known to attempt shore spawning (i.e. providing additional recruitment). Thus, Bruce Lake became a good candidate for this species. As a result, in 1995, Bruce Lake stocking efforts were switched from rainbow to brook trout.

The second stocking of rainbow trout (1999) was not intentional as a mistake occurred in the stocking requests. Therefore, any incidental rainbow trout captured in the 2002 assessment were examined but were not thoroughly investigated.

Brook Trout

Brook trout are not native to the Williston watershed and stocking these fish is restricted to closed systems. One of the reasons for this restriction is to limit the possibility of brook trout spawning with bull trout and producing a sterile hybrid. Bull trout are present in many systems in the Williston watershed. A beaver dam controls the lake level in Bruce Lake and negates any fish access in or out of the lake.

Bruce Lake is stocked every three years and was initially stocked with 10,000 viable brook trout (1995). The number of fish released in the next scheduled stocking period (1998) was reduced to 5,000 sterile fish. This stocking schedule has been maintained to date (Table 2). The average size at stocking of these fish has been about 5 g.

Table 2. Bruce Lake rainbow and brook trout stocking history.

Year	Species	Number	Size (g)	Life Stage	Stock
1989	RB	17 000	1.1	Fall Fry	Dragon
1995	EB	10 000	3.8	Fingerling	Aylmer
1998	EB	5 000	4.7	Fingerling	Aylmer 3N
1999	RB	5 000	1.7	Fall Fry	NRT Dragon
2001	EB	5 000	6.6	Fingerling	Aylmer AF 3N

METHODS

Three different techniques were used to determine relative abundance of fish species in Bruce Lake. Conversations with MWLAP fish biologists prior to the fish capture attempts suggested that it would be valuable to have at least 10 fish sampled from each age group to accurately provide future recommendations to the stocking program. Therefore, about 30 to 40 fish would provide enough data to understand the population structure in Bruce Lake.

The first method used was a sinking monofilament experimental gill net set overnight. The net consisted of six different sized mesh panels ranging from 25 to 85 mm. Each panel is 15.24 m long and 2.4 m wide. The gill net was set in the same location as in the 1994 survey to compare the catches between years.

A second method used was Gee traps. Each Gee trap (three in total) was baited with sardines and set overnight. The traps were set overnight in shallow (< 2 m) littoral habitat. The intent of these traps was to try and capture juvenile sized fish that are too small to be captured by the gill nets.

The third technique used to capture fish was angling gear. Angling efforts by PWFWCP fish biologists were also recorded to determine additional catch per unit effort (CPUE). A spin cast rod with an assortment of lures and a trolling fly rod with dry flies were utilised. Any anglers encountered during the assessment were also interviewed to determine their CPUE.

The brook and rainbow trout captured were measured for fork length (mm) and weight (g). A biological examination was conducted on fish caught, which revealed sex, maturity, stomach contents, and disease/parasite presence. Scale samples were taken from rainbow trout and otolith and pectoral ray samples were collected from brook trout for age determination. Fish ageing structures were analysed by North/South Consultants (NSC). General appearance of the fish was determined through visual analysis. Photos of fish were taken but are not presented in this report.

Mean lengths and weights were determined for each species of trout. Condition factors ($\text{Weight(g)/Length(cm)}^3 \times 100$) were determined for each individual fish. General growth comparisons were made between the two sample years (1994 and 2002 for brook trout). All other fish species were enumerated and the general appearance of these fish was observed and recorded. In addition, their minimum, mean, and maximum lengths were also recorded by species. Any non-game fish captured that were still alive in the gill nets were released immediately.

The habitat features of Bruce Lake were briefly assessed. The entire perimeter of the lake was observed to confirm presence/absence of inlet and outlet streams. The benchmark set during the original study (1989) was located. Changes to the current water level was measured with an Abney level, 1.5 m staff, and a 30 m Eslon tape. Any new campsites and other developments identified after the original survey were also recorded. Photo documentation was also taken of the lake but is not presented in this report.

A limnology station was established to profile the water temperature and dissolved oxygen at varying depths. The deepest part of the lake was identified with the aid of the bathymetric map and a depth sounder. A YSI model 58 oxygen/temperature meter was used to measure these conditions for the limnological profile. Oxygen and water temperature were recorded from the surface to the bottom at 1.0 metre intervals. Time and weather conditions were also recorded.

RESULTS

Of the three methods used to evaluate fish populations in Bruce Lake (Table 3), gill netting proved to be the most effective method of producing fish (30 of 31). Angling gear captured one rainbow trout while Gee traps produced only lake chub species.

Table 3. Lake catch summary for Bruce Lake, 2002.

Date	Species	Net Set		Angled	Gee Traps			Total	Number Sampled	Size Range (cm)
		1	2		1	2	3			
August 7-8	RB	1	10	1	0	0	0	12	12	33.3 – 47.1
August 7-8	EB	4	15	0	0	0	0	19	19	22.0 – 34.0
August 8	LKC	0	1	0	126	11	41	179	179	5.2 – 11.4

Gill Nets

One sinking gill net set was set overnight on August 7, 2002 (Figure 2). Gill net (GN) #1 was set for 27 hours and 50 minutes. The net was checked periodically throughout the day to avoid any high fish mortalities. The net check at mid-day produced one rainbow and four brook trout. The net was reset and when completely pulled yielded 10 rainbow trout, 15 brook trout, and 1 lake chub (Appendix 1). GN #1 was set in the same location as in the 1994 survey to compare the catches between years; however, the 1994 capture results were low so direct comparisons of catch provide limited value to assessing the lake's fishery in this case.

We used the power function ($W = aL^b$) to describe the current weight-length relationship of these fish. In general, a "b" value of less than 3.0 indicates a reduction in weight-gain per increment of length while a "b" value greater than 3.0 indicates an increase in weight-gain per increment of length. The results from this 2002 evaluation were not compared to the previous results of the 1994 evaluation on Bruce Lake as there were only two rainbow trout caught and no brook trout were stocked at that time. In 2002, the rainbow trout had a "b" value of almost 2.5 while the brook trout had a higher value of 2.9 (Figures 3 & 4).

The change in weight as a function of length is described by the equation Weight (g)= 0.07699 x Length (mm) $^{2.47}$, suggesting that the rainbow trout (Figure 3) exhibit growth that does change as they grow. These fish appear to be less rotund as their length increases. As for the brook trout, the change in weight as a function of length is described by the equation Weight (g)= 0.01563 x Length (mm) $^{2.94}$, suggesting that these fish (Figure 4) exhibit growth that is close to being isometric. The sampled brook trout appear to be slightly less rotund as their length increases.

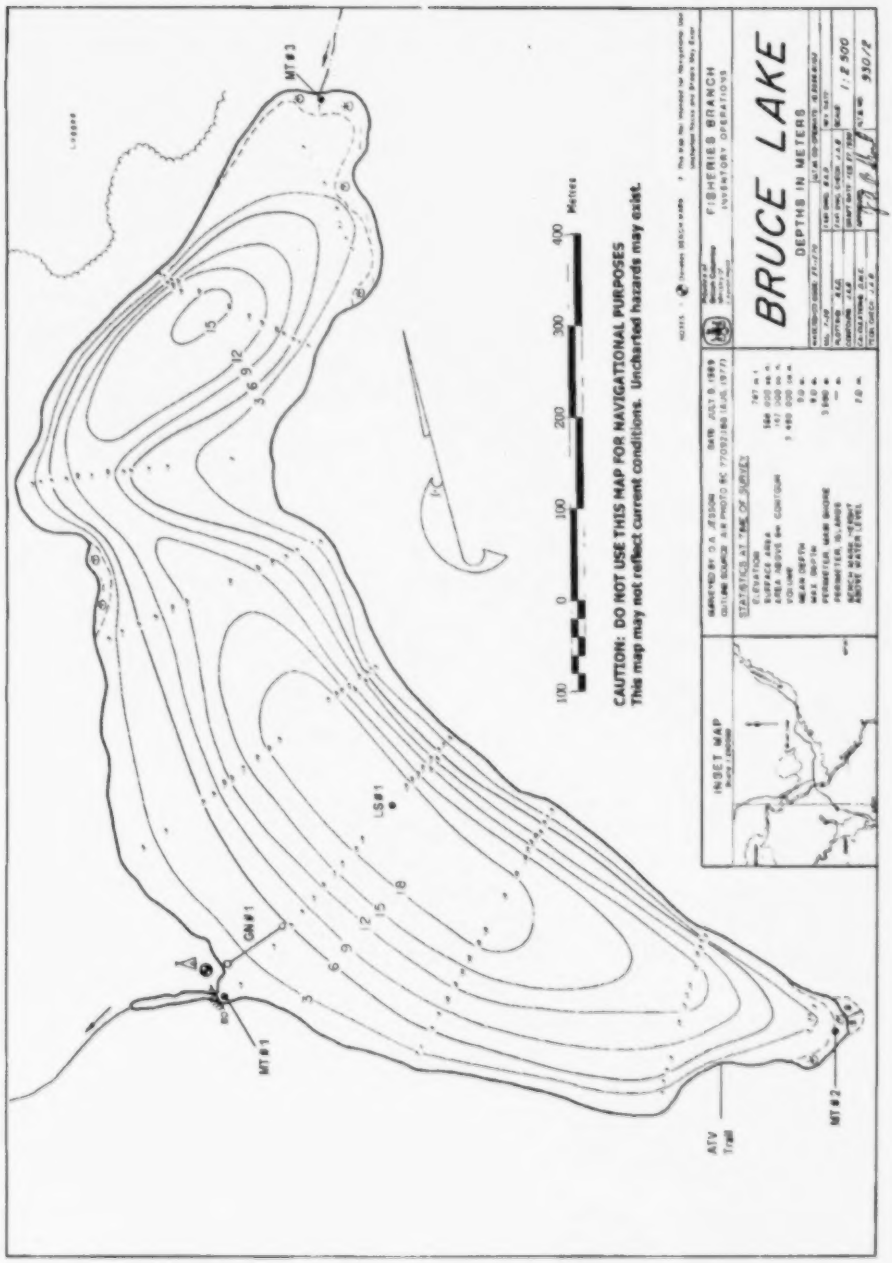

Figure 2. Location of gill net sets and minnow trap locations on Bruce Lake.

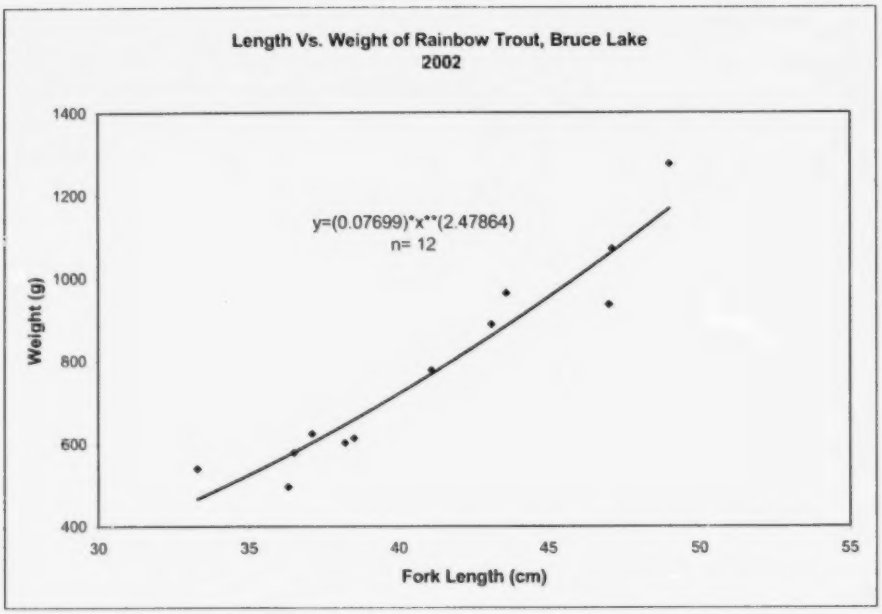

Figure 3. Length versus weight of rainbow trout in Bruce Lake, 2002.

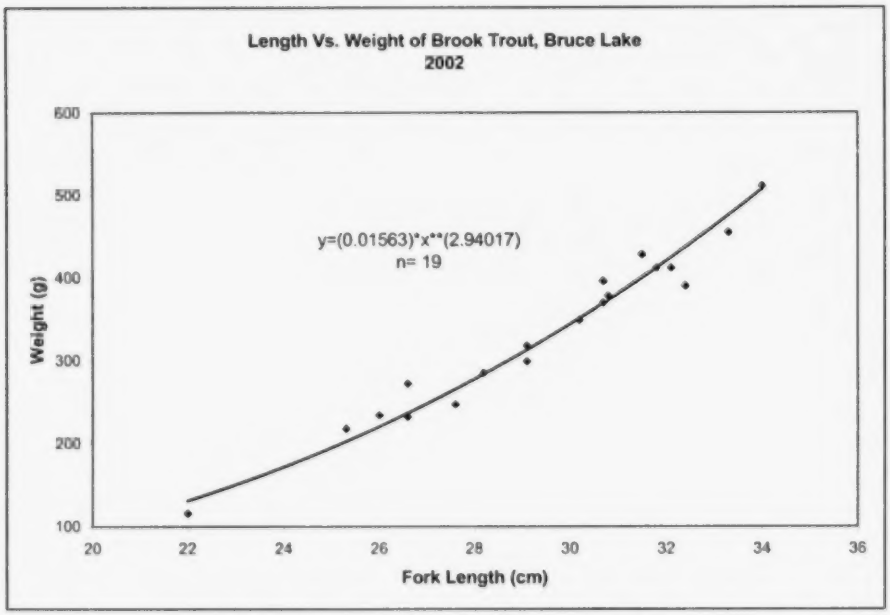

Figure 4. Length versus weight of brook trout in Bruce Lake, 2002 .

Age determination for the brook and rainbow trout (Appendix 2) is inconsistent and can not be used accurately to evaluate the sub-sample of fish collected in 2002. When examining the stocking records, the only age class deemed possible for the rainbow trout was age three fish while the brook trout ages should only contain two and five year old fish. The initial ages as determined by NSC contained additional ages for both species of fish.

There were three additional rainbow trout ages and two additional brook trout ages from what was originally preconceived. The rainbow trout samples were of poor quality and in some cases, the annuli were not distinct on the prints. This problem could result in underestimating the fishes age. We believe that with the lack of spawning habitat and the sterile strain of brook trout stocked. there is little opportunity for trout recruitment. Whether these additional ages are correct or not is open for further interpretation. One recommendation in trying to answer this problem would be to mark all of the future stocked fish going into the lake and re-assess at a later date.

Two separate types of structures were used to age the brook trout. Otoliths were collected as the primary age structure while pectoral fin rays were collected as a back up. All 19 brook trout were examined. The age data also contained some variances between ages depending on which ageing structure was used (Appendix 2). Information from the ageing consultant indicated that both the otoliths and the fins were of poor quality (more so the fins). The otoliths appeared opaque and the annuli were hard to detect. A second consultant took a look at the otoliths and he had problems with them as well. Final age determination for brook trout samples revealed that there were 3 age classes present: 2, 3, and 4 year old fish. Program staff were unable to review this data as prints of the ageing structures could not be made. Therefore, deciphering accurate growth comparisons in this assessment was difficult.

The sterile rate for 3N fish is typically around 99%. When examining the sterility of the brook trout stocked, there is approximately a 1% (50/5,000) chance that some of these fish could have been viable. In addition, brook trout have been known to successfully shore spawn. Although unlikely, it is possible that a few of these 50 viable fish each year have been able to successfully spawn and add recruitment to the lake. This may explain why there are some ages present on the non stocked years. As a result, the data is ultimately erroneous, and ideally, the ageing data should be re-collected.

Scale samples were taken from all 12 rainbow trout for ageing. Age determination for rainbow trout indicated that there were 4 age classes present in Bruce Lake: 3, 4, 5, and 7 year old fish. The majority of rainbow trout captured in GN #1 were between age class 4 (4 of 12) and age class 5 (5 of 12). Of the 12 scales examined, five were considered to be of poor quality and in some cases, the annuli were not distinct on the prints (Appendix 2). Further examination of these scales (prints) by Program staff revealed that 7 of these fish could possibly be age 3 while 5 of these fish were deemed older than age 3. Regardless of their ages, the focus of this stocking assessment was for the brook trout and not the rainbow trout. What may be of importance is that there could be some additional recruitment happening in Bruce Lake that we are not aware of.

The length at age data can not be used to accurately describe the fishes growth for the 2002 fish. Condition factors were then calculated (Table 4). This index of health can be used to compare samples between years. For the 2002 survey, mean lengths and weights (Table 5, Appendix 3), and condition factors for brook and rainbow trout were calculated and are compared, where possible, to the 1994 survey results (Table 5). The rainbow trout do appear healthy between the 1994 and 2002 sample years. The brook trout sampled in 2002 had a slightly higher average condition factor (1.27) than the rainbow trout (1.12). The brook trout population also appears to be healthy (Figure 5) and they are showing adequate growth as they get larger.

Table 4. Condition factors for trout captured in Bruce Lake in 1994 and 2002.

Condition Factor	1994 Rainbow Trout	2002 Rainbow Trout	2002 Brook Trout
Number of fish	2	12	19
Mean C.F.	1.30	1.12	1.27
Minimum C.F.	1.27	0.90	1.09
Maximum C.F.	1.33	1.46	1.45
Standard Deviation	0.04	0.14	0.08

Table 5. Population characteristics of trout in Bruce Lake, 2002.

Species	Sample No.	Mean Length (cm)	Range of Length (cm)	SD for Length	Mean Weight (g)	Range of Weight (g)	SD for Weight
EB	19	29.4	22 - 34	3.10	332.7	116 - 511	98.34
RB	12	40.9	33 – 49	5.04	780.9	496 – 1276	245.38

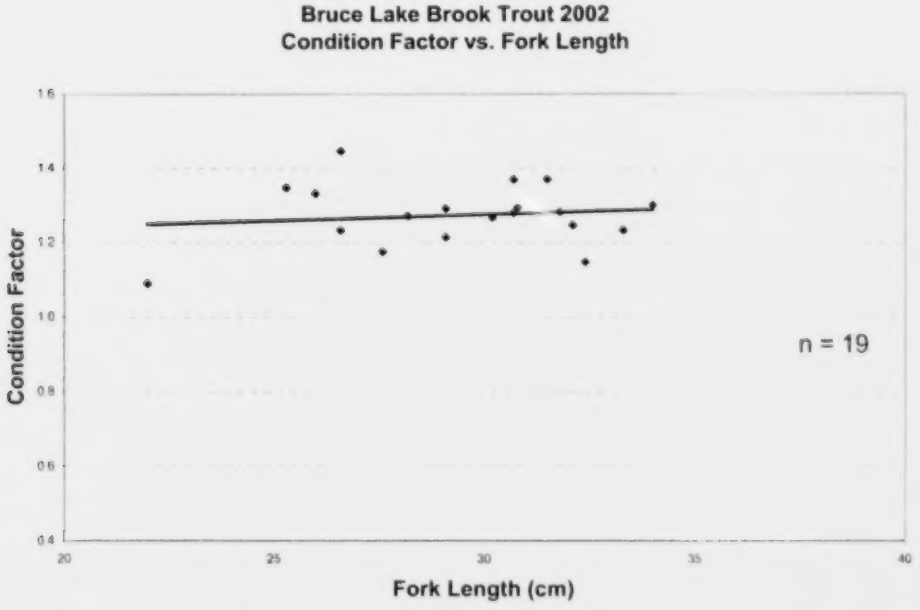

Figure 5. Condition factors by fork length of brook trout in Bruce Lake, 2002.

Plotting a length-frequency curve for the 2002 fish (to assist age verification) did not present any specific cohort distributions and is not presented in this report. Sample sizes were small for both trout species. We could see more than one age group on the plot for the few rainbow trout samples but no distinct ages could be determined. The brook trout samples mainly showed the one age group but with more variation in the lengths. This method of age determination can be unreliable for assigning ages to older fish as cohort distribution increasingly overlaps as fish become older. According to Laird Siemens (Manager of Kootenay Trout Hatchery, Fort Steele, BC), these brook trout only have a life span of 4 years. Therefore, by the time of this survey (2002), the viable fish stocked in 1995 should be deceased and no longer available for sampling. Based on the stocking records and the lack of spawning habitat available, there should only be three year old rainbow trout and two and five year old brook trout (unless the 1% viable fish are successfully shore spawning).

The final age data (based on what NSC determined) was plotted to obtain a rough estimate of evaluating the adult catchable brook trout (Figure 6). The data was not tested for any statistical validity but it appears that the food supply in Bruce Lake is adequate. These fishes condition is increasing as they get older and are contributing to a good recreational fishery.

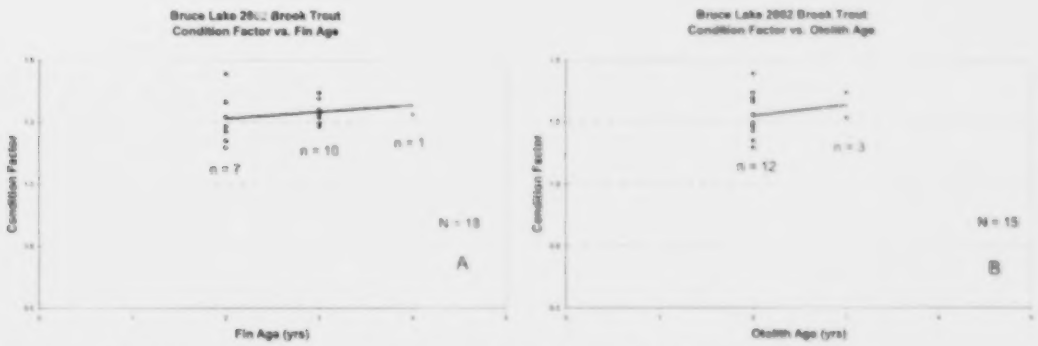

Figure 6. Condition factor by age structure of brook trout in Bruce Lake, 2002.

Gee Traps

Three Gee traps were used in an attempt to capture juvenile fish. The traps were set overnight (Figure 2) for a minimum of 30 hours (Table 6). Only lake chub were observed in the Gee traps.

Table 6. Gee trap results, Bruce Lake, 2002.

Trap No.	Hours Fished	Depth (m)	Substrate	Species	Number	Size Range (mm)
1	30 hr 25 min	1.0 m	Gravel + organics	LKC	126	52 - 86
2	30 hrs 30 min	0.6 m	organics	LKC	11	77 - 114
3	30 hrs 35 min	1.5 m	Organics with aquatic veg.	LKC	41	71 - 97

Angling

On August 7, Program biologists angled for 1.5 hours using two rods and caught one rainbow trout. Catch per unit effort is 0.33 fish per rod hour. The rainbow trout was 47.0 cm long and weighed 936.0 g and was released alive. Only a length, weight, and scales were taken for this fish.

Limnology

An oxygen/temperature profile station was established at the determined deepest part of the lake (Figure 2). The limnology profile was completed on August 7, 2002 at 1135 hours. Weather conditions were 5% overcast with ~10 km/h winds. Water temperature and dissolved oxygen measurements were taken at 1.0 m intervals (Table 7). A few of the deeper depths were omitted as there were little changes in the readings.

The water temperature at the surface was quite warm (> 15° C). The metalimnion at the time of the survey was around the 4 m depth. Oxygen levels were adequate for trout in the top 5 to 6 m. Lethal oxygen concentrations for these trout occur around the 12 to 13 m depth and these fish are not expected to inhabit the lake below this oxygen depleted zone.

Table 7. Limnology Profile for Bruce Lake, August 7, 2002.

Depth	Dissolved Oxygen (O_2)	Temperature (° Celsius)
surface	8.8	15.8
1 m	8.8	15.6
2 m	8.8	15.3
3 m	8.2	15.2
4 m	9.7	13.0
5 m	8.7	9.7
6 m	6.7	7.0
7 m	5.0	6.0
8 m	4.7	5.3
9 m	4.4	5.1
10 m	3.8	5.0
11 m	-	-
12 m	3.2	4.6
13 m	-	-
14 m	2.1	4.3
15 m	-	-
16 m	-	-
17 m	0.7	4.2
18 m	bottom	bottom

BIOLOGICAL ANALYSIS OF RAINBOW TROUT

A biological analysis was conducted on 11 rainbow trout (Appendix 2). About one third of the fish were males and two thirds were females. Reproductive organ analysis revealed that most fish were maturing (9), with one immature, and one spawnbound fish. Examination of stomach contents suggest that rainbow trout are preying primarily on zooplankton. Other common foods included: shrimp, various insects, and a few fish. External examination indicated healthy fish while internal examination revealed some tapeworms in their stomachs.

BIOLOGICAL ANALYSIS OF BROOK TROUT

A biological analysis was conducted on 19 brook trout (Appendix 2). Reproductive organ analysis was inconclusive in classifying sex or gonadal maturity of the brook trout. These fish have been most recently stocked as sterile fish and therefore do not produce gonads. Although, one fish was a viable maturing female. Examination of stomach contents suggest that brook trout are preying primarily on zooplankton. Other common foods included: unknown fish species, black flies, larval insects, snails, shrimp, and dragonflies.

DRAINAGE

The entire perimeter of the lake was examined for any inlets or an outlet. The small inlet stream, on the north shore, is intermittent and has no fisheries value. Bruce Lake is still a closed system. The lake level is controlled by an old beaver dam (90 cm height and ~ 30 m in length) located at the southwest end of the lake. A small trickle of water was observed on the downstream side of the dam. The dam is a barrier to fish passage. Approximately 5 m downstream of the dam, the channel had a wetted width of 25 cm and a depth of 3 cm. The substrate was organic with no gravels and is not suitable habitat for trout spawning. Approximately 50 m downstream of the first dam was a second dam that was breached in two locations. The habitat characteristics of this outlet have not changed a great deal since the 1994 lake assessment (Zemlak and Langston 1994). Pictures of the dams were taken for documentation and are on file at the PWFWCP office.

BENCHMARK

The benchmark, located on the west shore, was re-located by Program biologists during the 2002 survey (Figure 2). The benchmark was originally set during the 1989 survey at an initial height of 2.0 m above the current water level, 5.5 m from shore (water's edge). The 1994 survey indicated that the lake level had dropped 18 cm (from 1989). The 2002 survey found the benchmark 6.3 m from shore (water's edge) in a 25 cm D.B.H. spruce tree. The spike was at

2.09 m above the current lake level, indicating a rise in the lake level of 0.09 m since 1994. The benchmark was re-painted orange.

FISHERIES MANAGEMENT COMMENTS

Rainbow Trout

Rainbow trout were stocked in Bruce Lake in 1989 and 1999. The stocking in 1999 was a mistake and ideally should not have taken place. The rainbow trout caught in August 2002 appear to be healthy and had a mean condition factor of 1.12 (n = 12). These fish are slightly smaller than the two fish caught in October 1994. One of the rainbow trout was spawnbound and had numerous loose eggs. The outlet is blocked for fish access and has limited to no fisheries value associated with it. The inlet is intermittent and also has no fisheries value. As a result, the current rainbow trout in Bruce Lake have no suitable spawning habitat.

Although the ageing data for these fish can not be verified, there is definitely more than one age class of rainbow trout present within Bruce Lake. This statement can be verified by the fact that two of the similar sized fish had substantially different weights. One captured fish was 363 mm FL and weighed 496 g while a second fish was 471 mm FL and weighed 1,071 g. It is very unlikely that these fish can double their weight and still be the same age. The ageing results from NSC verified the fact that there is more than one age present. Since there has only been one recent stocking for rainbow trout (1999) and a minimum of two ages are present, then this would suggest that these fish are able to successfully reproduce within the closed lake system. An unidentified spring may be in Bruce Lake that allows the rainbow trout to release their eggs and thereby prevent greater spawnbound problems within the stock as well. PWFWCP biologists did not observe any shore spawning activity locations within Bruce Lake (although the timing of this survey would have been too late to observe that activity). As this lake is being managed strictly for brook trout, no further stocking of rainbow trout will take place.

Brook Trout

Bruce Lake supports a healthy population of stocked brook trout. The average condition factor for the 19 captured fish was 1.27 which indicates that the health of the population is normal. This condition confirms that Bruce Lake can continue to support the same number of fish. However, the number of fish captured appears low for the number of fish stocked. Bruce Lake currently receives 5,000 fish every three years. The gill net CPUE appears low at 0.64 fish per hour.

This low CPUE may be an indication that angling pressure is high and may have removed a portion of the stocked fish over time. Angler use on this lake is unknown. Anecdotal information suggests Bruce Lake is used by many ice fishermen. The PWFWCP conducted an aerial boat count on this lake during the summer of 2002. Ice fishing holes were observed during

the May flights (prior to ice-off). Summer use appeared to be low but needs to be further verified with a ground based creel survey.

Age determination for the 19 brook trout proved to be difficult. There was a lot of discrepancy between the otolith and fin rays ages. Based on the stocking efforts, only age 2 and 5 fish should be present. The majority of fish (14 of 19) appear to be age 2 fish (based on otoliths ages). The remainder of fish were comprised of age 3 and 4 fish. Since the rainbow trout appear to have successfully spawned in Bruce Lake, this may suggest that there could be more than the age 2 and 5 brook trout present. The identified ages (3 and 4) for brook trout could be possible (i.e. recruitment from the 1% viable fish stocked).

This recruitment is presumed unlikely. Although, 1 of these 19 fish (aged 3 to 4) was maturing. This fish is either one of the few 3N's that became viable, or is the progeny of the 1995 brood stock (which was not sterile). It remains unknown where this fish originated and what the true ages are for these fish. Additional sampling is recommended to confirm the status of potentially viable brook trout within Bruce Lake.

Non-game fish

Bruce Lake also supports a population of lake chub. Lake chub were observed in the stomach content analysis of four trout. Although not studied intensively, the lake chub population appears to be abundant but may be lower when compared to previous surveys. In 1989, two Gee traps produced a CPUE of 5.0 lake chub per hour. The CPUE for the two Gee traps used in 1994 was 3.4 fish per hour while similar traps captured 2.2 fish per hour in 2002. One of the trap locations was different in 1989 as compared to the other two sample years.

While Gee traps are generally used for presence/absence counts, there are many different reasons for the difference in the CPUE between years. For example, once the bait is gone (eaten), the fish are more likely to find the opening and escape the trap. Thus, traps set for an extended period may underestimate fish numbers. In addition, the time of year can make a difference in capture rates. Lake chub, for example, can occupy different areas of the lake at different times of the year. It is unknown if the trout are having an impact on the overall lake chub population.

MISCELLANEOUS COMMENTS

1. Photographs of Bruce Lake were taken of some of the captured fish. Additional pictures were taken of the surrounding lake habitat. Most photos were taken to document the change in features over time (i.e. outlet habitat) and are not significant to the relevance of this report on fish stocking. Therefore, these photos are not displayed in this fish stock assessment report but can be viewed at the PWFWCP office (address indicated at the beginning of this report).

FISH STOCKING PROGRAM

The objective of the fish stocking program is to provide a recreational fishery suitable to anglers throughout each season. Currently, Bruce Lake is being stocked every three years with sterile brook trout. While one of the considerations of the stocking program is to kept the costs at a minimum, it is recommended that the stocking frequency and number of fish stocked be altered in the future.

These triploid fish originated from Aylmer Lake. The current condition of the Bruce Lake stocked brook trout appear to be in good health (b = 2.9, C.F. = 1.27). If the current three-year stocking schedule were to be continued, then there would be some low productive angling years in the near future. For example, in the year 2004, there would be three possible age classes present: 1, 4, and 7 year old fish. Obviously, the age 1 fish would not contribute to the fishery. The age four fish are nearing their maximum life span and there probably would be very few of these fish remaining in the lake to angle. And, the possibility of seven year old fish is highly unlikely. Therefore, anglers who fish Bruce Lake in 2004 would probably be very unsatisfied with their angling experience.

With this information, we recommend that Bruce Lake be stocked every two years in order to alleviate the low angling CPUE years which arise from the current three year stocking cycle. In addition, when assessments are to be conducted, there is a better chance of obtaining growth data from two age classes as opposed to one. Most lake assessments are conducted again within a 5 year time frame. If the majority of age data collected in 2002 was deemed correct, then we would only have the age 2 fish to analyse. Making recommendations on one age class can be difficult. Having at least two distinct age classes present in the future would provide a better indication as to what the population structure and growth rates of these fish are like within Bruce Lake.

With the new bi-annual stocking schedule, the next scheduled stocking would occur in 2004. Requests for egg collection to stock fish have already been completed and requests to mark the fish stocked in the summer of 2004 have been accepted. The next scheduled stocking after 2004 would be in 2006 and then 2008 etc.

There are no signs of stunting which would suggest that the lake is not being over-stocked. In order to keep the stocking costs to a minimum, it is recommended to slightly reduce the number of fish stocked each year to 4,000 fish. With the current stocking amount (5,000 fish every 3 years), Bruce Lake is able to support 15,000 fish stocked within a 7 year time frame. If the stocking schedule changed to 4,000 fish every second year, then Bruce Lake would receive 16,000 fish in a 7 year time frame. Bruce Lake should be able to accommodate an extra 1,000 fish over this 7 year time span.

We believe at this time that there are fewer ages of fish than what are being reported by NSC. The additional ages identified are unlikely unless these fish are successfully shore spawning. Although, this concept has not been ruled out. According to Laird Siemens (Manager of Kootenay Trout Hatchery, Fort Steele, BC), these brook trout generally only have a life span of 4

years. Brook trout stocked in other lakes in the Omineca Region are reaching ages older than 4 years old (*Ted Zimmerman*, MWLAP, pers. comm.). One possible solution to the additional ages identified with our sample is that spawning is likely occurring the lake. Regardless of these ages, the data is inconclusive. We therefore recommend that another assessment take place with marked fish to help answer the potential of recruitment in the lake.

The next scheduled assessment should be conducted in 2007. By that time, the fish will be aged 2, 4, and possibly 7 years old. Realistically, this population of fish will have two distinct age classes present (2 and 4) to assess. In addition, the age two data collected in 2007 may be comparable to the possible age two data collected in 2002. During the next assessment, it is also recommended to conduct the survey in early October and examine the lake for any evidence of shore spawning brook trout.

OTHER RECOMMENDATIONS

An accurate estimate on angler use on Bruce Lake is unknown at this time. The aerial boat count surveys conducted in 2002 suggests that Bruce Lake is used by anglers but maybe not as much as other lakes in the area. Future creels would provide a better indication of what kind of fishery people prefer (i.e. more fish or bigger fish). The lake is used by ice fisherman but to what extent is unknown. A creel survey would provide greater information of the pressure put on Bruce Lake and determine if large numbers of the stocked fish are being removed in the winter fishery.

Another more economical way to determine the CPUE would be to conduct a limited creel survey during high use periods (i.e. long weekends). This survey may be a more cost effective means to obtain CPUE data without having to conduct a full creel survey. Future data collection and anecdotal information received will provide a better idea of the angler use/CPUE and would assist with the future stocking recommendations for Bruce Lake.

LITERATURE CITED

Jesson, D.A. 1989. A Reconnaissance Survey of Bruce Lake. Peace/Williston Fish and Wildlife Compensation Program. Report No. 86. 18pp plus appendices.

Zemlak, R.J. and A.R. Langston. 1994. Fish Habitat Enhancement Potential and Stocking Assessment of Bruce Lake. Peace/Williston Fish and Wildlife Compensation Program. Report No. 123. 12pp plus appendices.

APPENDIX 1

Netting Record

Lake: Bruce

NETTING RECORD **August 8, 2002**

Mesh sizes experimental order: 25, 76, 51, 89, 38, 64 mm

NETTING SITE #1			
Type:	Sinking monofilament gill net		
Date Set:	August 7, 2002	Time:	1100 hrs
Date Lifted:	August 8, 2002	Time:	1550 hrs
Net Dimensions:	Length: 91.4 m	Depth:	2.4 m
Shallow End Mesh Size:	25 mm	Depth: Substrate:	0.9 m organics + aquatic plants
Deep End Mesh Size:	64 mm	Depth: Substrate:	8.5 m ?

Comments:

Set in the same location as the 1989 and 1994 surveys. Net was checked at 1440 hrs on August 7. One rainbow trout and four brook trout were caught and sampled. Net was reset overnight. Gill net # 1 was then pulled in the afternoon and produced a total of 11 rainbow trout, 19 brook trout, and 1 lake chub.

APPENDIX 2

North/South Consultants Age Data

Lake: Bruce

AGE DETERMINATION
Scale, Pectoral Rays, and Otolith Analysis

COMPLETED BY:
North/South Consultants - Paul Graveline
83 Scurfield Blvd.
Winnipeg, Manitoba, R3T 1G4

Age analysis/comments by North/South Consultants on the trout captured in Bruce Lake, 2002.

FISH ID	SPECIES	LENGTH (mm)	WEIGHT (g)	SCALE AGE	OTOLITH AGE	FIN AGE	COMMENTS	FIN COMMENTS
1	RB	470	936	5			Poor	
2	RB	382	603	3			Poor	
3	RB	333	540	3			Poor	
4	RB	365	579	4			Poor, not indicated	
5	RB	436	964	5				
6	RB	385	614	4				
7	RB	371	625	4				
8	RB	431	889	5				
9	RB	363	496	4				
10	RB	490	1276	7				
11	RB	471	1071	5			Poor, not indicated	
12	RB	411	778	5				
1	EB	340	511			3	Oto. unageable	Poor
2	EB	291	299		2	2		Poor
3	EB	291	318			3	Oto. unageable	Poor
4	EB	282	285			2	Oto. unageable	Poor
5	EB	260	234		2	2	Poor	Poor
6	EB	307	396		2	3	Poor	Poor
7	EB	266	272		2	2		Poor
8	EB	318	412		3	4		Poor
9	EB	321	412		2	3		Poor
10	EB	266	323		2	2		Poor
11	EB	307	370		2	3		Poor
12	EB	308	378			3	Oto. unageable	Poor
13	EB	302	349		3	3		Poor
14	EB	315	428		3	3		Poor
15	EB	276	247		2	2	Poor	Poor
16	EB	220	116		2		Poor	Unageable
17	EB	324	390		2	2		Poor
18	EB	253	218		2	3		Poor
19	EB	333	455		2	3		Poor

APPENDIX 3

Individual Fish Data

Lake: Bruce

INDIVIDUAL FISH DATA

Date Captured: August 7, 2002
Gill Net Set # 1: 2.4 hour soak

M - Male
F - Female
? - Not Obvious

IMM - Immature
MG - Maturing
MT - Mature
GV - Gravid
SP - Spent
? - Not Obvious

EG - Egg
ML - Milt
HD - Head
TG - Fish Tag
ST - Stomach

SC- scale
FR- Fin Ray
PR-pectoral ray
OT - Otolith
WF - Whole Fish

Method of Capture: sinking monofilament gillnet
Condition Factor (K) = $W / L^3 \times 100$

Species	Fork Length (cm)	Weight (grams)	Condition Factor	Gonadal Maturity	Sample Type	Stomach Contents				Comments
						Plankton	Insects	Fish	Other	
RB	47.0	936	0.90	?	SC	?	?	?	?	Angled, released alive
RB	38.2	603	1.08	IMM	SC	lots + lots of zooplankton	snail			GN # 1 parasite on stomach
EB	34.0	511	1.30	?	OT + PR	lots of zooplankton	shrimp			GN # 1 gonads visible
EB	29.1	299	1.21	?	OT + PR	lots of zooplankton		1 unknown fish		GN # 1 gonads not visible
EB	29.1	318	1.29	?	OT + PR			1 unknown fish		GN # 1 gonads not visible
EB	28.2	285	1.27	?	OT + PR		dragonfly nymph X 2		? larval stage	gonads not visible

Ch. chaoborus
Cl. clams
G. gammarus
Le. Leeches
P.M. phantom midge
O.M. organic matter
L. lice
T.W. tapeworms
S. snails
M. mayflies (general)
Da. daphnia
Di. diptera
Ca. callibaetis

Lake: Bruce

INDIVIDUAL FISH DATA

Date Captured: August 8, 2002
Gill Net Set # 1: Rainbow Trout

M - Male
F - Female
? - Not Obvious

IMM - Immature
MG - Maturing
MT - Mature
GV - Gravid
SP - Spent
? - Not Obvious

EG - Egg
ML - Milt
HD - Head
TG - Fish Tag
ST - Stomach

SC- Scale
FR - Fin Ray
PR-pectoral ray
OT - Otolith
WF-Whole Fish

Method of Capture: sinking monofilament gillnet
Condition Factor (K) = $W / L^3 \times 100$

Species	Fork Length (cm)	Weight (grams)	Condition Factor	Gonadal Maturity	Sex	Sample Type	Stomach Contents				Comments
							Plankton	Insects	Fish	Other	
RB	33.3	540	1.46	MG	F	SC	lots zooplankton				not spawnbound
RB	36.5	579	1.19	MG	F	SC	lots zooplankton	insect ?			not spawnbound
RB	43.6	964	1.16	MG	M	SC	lots zooplankton	shrimp insect			
RB	38.5	614	1.08	MG	F	SC	lots zooplankton	shrimp insect ?			
RB	37.1	625	1.22	MG	F	SC	lots zooplankton				
RB	43.1	889	1.11	Spawnbound	F	SC				empty	spawnbound w/ lots eggs
RB	36.3	496	1.04	MG	M	SC	zooplankton	insect ?		detritus	tapeworms (10)
RB	49.0	1276	1.08	MG	F	SC	lots zooplankton				not spawnbound
RB	47.1	1071	1.03	MG	M	SC		shrimp (6)			
RB	41.1	778	1.12	MG	F	SC		fish			

Ch. chaoborus
Cl. clams
G. gammarus
Le. leeches
P.M. phantom midge
O.M. organic matter
L. lice
T.W. tapeworms
S. snails
M. mayflies (general)
Da. daphnia
Di. diptera
Ca. callibaetis

Lake: Bruce

INDIVIDUAL FISH DATA

Date Captured: August 8, 2002
Gill Net Set # 1: Brook Trout

M - Male
F - Female
? - Not Obvious

IMM - Immature
MG - Maturing
MT - Mature
GV - Gravid
SP - Spent
? - Not Obvious

EG - Egg
ML - Milt
HD - Head
TG - Fish Tag
ST - Stomach

SC- Scale
FR -Fin Ray
PR-pectoral ray
OT - Otolith
WF - Whole Fish

Method of Capture: sinking monofilament gillnet
Condition Factor (K) = $W / L^3 \times 100$

Species	Fork Length (cm)	Weight (grams)	Condition Factor	Gonadal Maturity	Sex	Sample Type	Stomach Contents				Comments
							Plankton	Insects	Fish	Other	
EB	26.0	234	1.33	?	?	OT X 2			fish ?		
EB	30.7	396	1.37	?	?	OT X 2	zooplankton				
EB	26.6	272	1.45	?	?	OT X 2	lots zooplankton				
EB	31.8	412	1.28	MG	F	OT X 2		black flies larval insect			
EB	32.1	412	1.25	?	?	OT X 1	lots zooplankton				
EB	26.6	232	1.23	?	?	OT X 2	zooplankton	winged insect			
EB	30.7	370	1.28	?	?	OT X 1	zooplankton				
EB	30.8	378	1.29	?	?	OT X 1	little zooplankton	dragonfly			
EB	30.2	349	1.27	?	?	OT X 1	lots zooplankton				
EB	31.5	428	1.37	?	?	OT X 2	lots zooplankton				
EB	27.6	247	1.17	?	?	OT X 2	zooplankton				
EB	22.0	116	1.09	?	?	OT X 2	zooplankton				
EB	32.4	390	1.15	?	?	OT X 1	zooplankton				
EB	25.3	218	1.35	?	?	OT X 2	zooplankton				
EB	33.3	455	1.23	?	?	OT X 2					empty

Ch.	chaoborus	P.M.	phantom midge	T.W.	tapeworms	Da.	daphnia
Cl.	clams	O.M.	organic matter	S.	snails	Di.	diptera
G.	gammarus	L.	lice	M.	mayflies (general)	Ca.	callibaetis
Le.	leeches						